

First records of lowland tapir, *Tapirus terrestris* (Perissodactyla, Tapiridae), outside conservation areas after 30 years, in Santa Catarina, southern Brazil

Douglas Ticiani¹, Osvaldo Onghero Jr.¹, Mario Arthur Favretto²

1 *Desenvolver Engenharia e Meio Ambiente, Rua Sete de Abril, 3489, Parque Jardim Ouro, Ouro, Santa Catarina, Brazil*

2 *Federal University of Santa Catarina, Campus Universitário, Trindade, Florianópolis, Santa Catarina, Brazil*

Corresponding author: Douglas Ticiani (ticiani.douglas@gmail.com)

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Abstract

Intense hunting pressure and habitat loss have significantly reduced populations of the lowland tapir *Tapirus terrestris* in southern Brazil. Remaining individuals inhabit mainly legally protected areas. Here we report the first records outside of conservation areas in the state of Santa Catarina, over the last 30 years. These records were found during a mammal monitoring program, developed between May 2018 and July 2020. The records provide new evidence of the distribution of the species in Santa Catarina and reinforce the relevance of connectivity between protected areas of the Serra do Mar Ecological Corridor.

Keywords

ecological corridors, geographic distribution, mammals, neotropical fauna, threatened

Introduction

The lowland tapir, *Tapirus terrestris* (Linnaeus, 1758), is the largest Brazilian land mammal, with records from northern South America to Paraguay and northern Argentina, inhabiting lowland forested areas to montane forests up to 1,800 m above

sea level (Downer 2003; Sekiama et al. 2011; Bornschein et al. 2012). Its diet is composed of fruits, sprouts, tender stems, branches, aquatic plants, and even certain monoculture vegetables (Downer 2003; Sekiama et al. 2011). It has an important functional role in zoochory, contributing to the dispersal of approximately 60 different plant species in the Brazilian Atlantic Forests (Tófoli 2006). For this, it is considered an important bioindicator of the health of the ecosystem and maintenance of biodiversity, especially of frugivorous and herbivorous species (Bodmer 1991; Fragoso 1997; Dario 2014).

Tapirus terrestris is a wide-ranging herbivore considered a “landscape species”, that requires large areas for its survival (Coppolillo et al. 2004). Due to its zoochorous ability, it contributes to restore connectivity between altered and conserved systems (Giombini et al. 2016; Paolucci et al. 2019). However, this exposes the species to human-impacted areas and consequently to a variety of threats to its survival (Medici and Desbiez 2012). Therefore, in some Brazilian biomes, the lowland tapir has been reduced to the point that remaining individuals are restricted to protected areas (Medici et al. 2012).

The state of Santa Catarina has 249 protected areas in its territory, but not all are legally recognized, or have information available about their size (Martins et al. 2015). For those with available data, the protected areas represent approximately 5.0% of the state's territory. These areas represent an important refuge for the remaining *T. terrestris* populations, especially those located in the northern and central coastal regions of Santa Catarina, where the only records for the state in the last 30 years were documented, restricted to the Sassafrás State Biological Reserve (Tortato et al. 2014), Serra do Tabuleiro State Park (Santos et al. 2005; Oliveira-Santos et al. 2010), and Serra da Dona Francisca Environmental Protection Area (Joinville 2012), where most of the historical records of lowland tapirs are also documented (Azevedo et al. 1982; Olimpio 1995; Cherem et al. 2004). Records in the southern coast and western portion of Santa Catarina were obtained from zooarcheological sources (Olimpio 1995; Rosa 1998; Castilho and Simões-Lopes 2001; Carvalho 2006; Ferrasso and Schmitz 2013), indicating that the population decline of the species in these regions matches the intense logging period in the early 1900s (Cabral and Cesco 2008). The most recent report of *T. terrestris* out of a protected area was found in the environmental impact assessment of the Cubatão Hydroelectric Power Plant in 1989 (Olimpio et al. 1991). The dam was not built and today the site is located within the limits of Serra da Dona Francisca Environmental Protection Area.

In the Atlantic Forest, there is no quantitative information on population decrease of the lowland tapir in the past (Medici et al. 2012). It is estimated that there are only three remnant areas in this biome that maintain genetically viable populations, containing more than 200 individuals, and 40% of the total tapir population is sheltered by the Serra do Mar geological formation (Medici et al. 2012), an important Ecological Corridor in the Brazilian Atlantic Forest (Aguilar et al. 2003). However, most of the remaining individuals inhabit highly fragmented forest areas and are under intense pressure from hunting, road kills, and habitat quality loss due

to urban growth (Medici et al. 2012). All this human pressure makes this species be considered 'Endangered' (EN) within the Santa Catarina and Atlantic Forest (Santa Catarina 2011; Medici et al. 2012), and Vulnerable (VU) at national and international levels (Brasil 2014; IUCN 2020). Furthermore, the species is considered extinct in most of the northeastern Atlantic Forest areas (Silva Jr. and Mendes Pontes 2008).

Considering that more than 70% of lowland tapir populations in the Atlantic Forest have fewer than 200 individuals, estimates indicate a decline of up to 50% of this species population in the biome by 2045 (Medici et al. 2012). In view of the intense pressures on the species natural life areas, as well as their ecological importance for the ecosystems it inhabits, this document aims to report new records of *T. terrestris* in Santa Catarina, the first outside protected areas after 30 years. This information contributes to the knowledge about the current geographic distribution of this species in the state and can subsidize actions for the conservation of tapirs.

The records are part of the faunistic monitoring developed in the upper stretch of the Itapocuzinho River Basin, north of the state of Santa Catarina, southern Brazil (Fig. 1). The regional vegetation cover consists of Dense Ombrophylous Forests, typical of the coastal Brazilian Atlantic Forest Biome (Vibrans et al. 2013). The ombrothermal characteristic is linked to tropical climatic factors including high temperatures and well-distributed precipitation during the year with practically no extreme dry season (Klein 1978; IBGE 2012). The sampled forest remnants integrate the geological formation of the Serra do Mar, a significant remnant of the Brazilian Atlantic Forest which extends along the coastline for approximately 1000 km, from north of Santa Catarina to southwest of Rio de Janeiro (Almeida and Carneiro 1998).

The records reported here were obtained through the line transect sampling in which the active search for specimens and/or traces of mammals is performed (Cullen and Rudran 2006). The study included eight seasonal incursions between May 2018 and July 2020. In each sampling campaign, searches were conducted at dawn and dusk for three consecutive days, totaling 12 sample hours per campaign. The total area sampled was approximately 3.55 km², covering a total of 82 km of linear transects.

We recorded three traces (footprints) of *T. terrestris*. Two of these were during the summer (January) and winter (July) of 2019 sampling, both in the same place (26°17'54.40"S, 49°8'59.48"W, 758 m a.s.l.). The third trace was found during winter (July) of 2020 about 1.2 km from the previous ones (26°17'23.64"S, 49°8'36.41"W, 756 m a.s.l.). The identifications were confirmed through specific guides (De Angelo et al. 2015; Prist et al. 2020). According to these guides, the absence of interdigital membranes, trapezoidal plantar pad, greater width and less spacing between the digits, are the main characteristics of lowland tapir footprint. Due to the smaller footprint size, the last record is a different individual from the previous ones (Fig. 2). These results provide evidence of reproductive success and suggest that there are at least two locally established adult individuals. In addition, local residents reported recent visual observations of two individuals (one adult and one young), close of the third trace, an important anecdotal evidence that reinforces our findings.

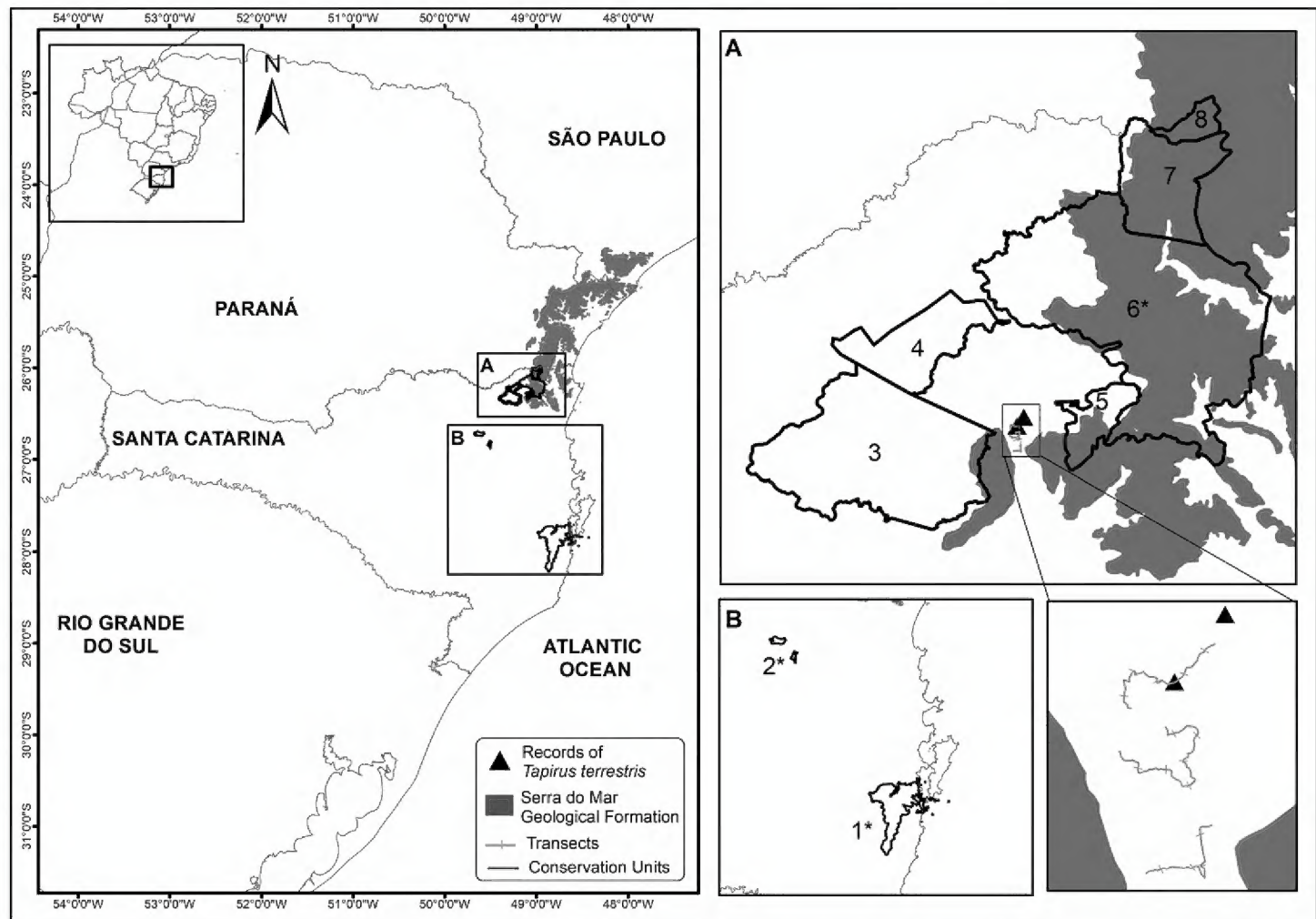


Figure 1. Location of new records of lowland tapir *Tapirus terrestris* in relation to documented occurrences in protected areas in the state of Santa Catarina, southern Brazil. **A** and **B** show details of areas with records of lowland tapir in the state. 1: Serra do Tabuleiro State Park; 2: Sassafrás State Biological Reserve; 3: Rio Vermelho Environmental Protection Area; 4: Alto Rio Turvo Environmental Protection Area; 5: Bracinho Ecological Station; 6: Serra da Dona Francisca Environmental Protection Area; 7: Quiriri Environmental Protection Area; 8: Campos do Quiriri Environmental Protection Area. * protection areas with records of *Tapirus terrestris* in the last 30 years.

The low frequency of recordings reflects a low density of the species in the study region. In other areas of the Atlantic Forest, the documented population density for the *T. terrestris* is generally lower than 1 ind./km², as in the Araucária Ecological Corridor, in Paraná (0.09 ind./km²) (Vidolin et al. 2011), and in the Pontal do Paranapanema region, in São Paulo (0.30 to 0.47 and 0.21 to 1.35 ind./km²) (Cullen et al. 2000; Medici 2010, respectively). In the State Park of Turvo, in Rio Grande do Sul, studies with similar sampling methods (128 and 341km of linear transects) also obtained few lowland tapir records (eight and three records) (Kasper et al. 2007; Filho 2007, respectively). These confirm that the southern region of Brazil is among the areas with the most reduced *T. terrestris* populations in the country (Taber et al. 2007). Furthermore, the remaining individuals are generally restricted to conservation parks such as the Turvo State Park, the only place in the state of Rio Grande do Sul to have records of this species, in recent decades (Medici et al. 2012).

The same is observed in Santa Catarina, whose documented records in the last 30 years are restricted to the Serra do Tabuleiro State Park, Sassafrás State Biologi-

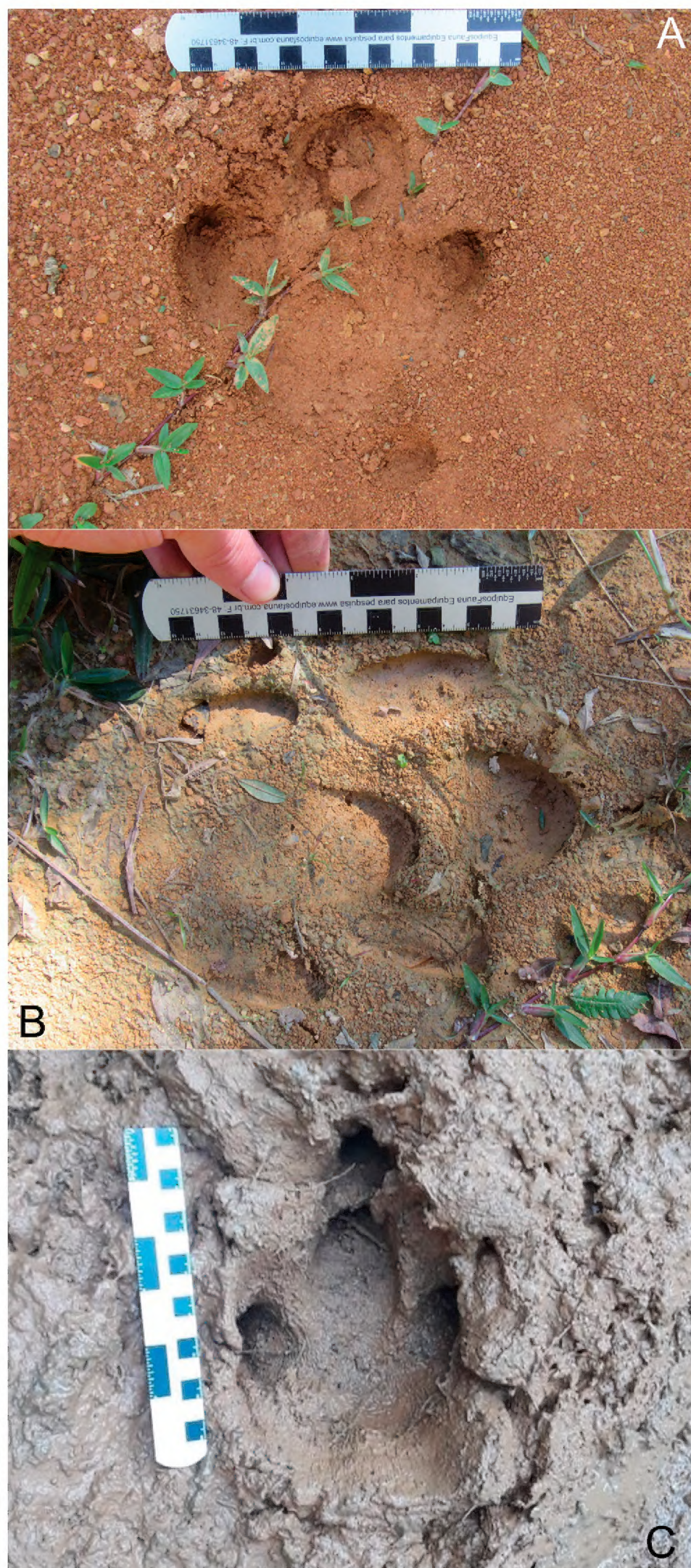


Figure 2. Footprints of lowland tapir *Tapirus terrestris* recorded in summer 2019 (A), winter 2019 (B) and winter 2020 (C), in southern Brazil. Photos A and B: Douglas Ticiani; Photo C: Denyelle Hennayra Corá.

cal Reserve and Serra da Dona Francisca Environmental Protection Area (Santos et al. 2005; Oliveira-Santos et al. 2010; Joinville 2012; Tortato et al. 2014). The present study area is located approximately 161.0, 62.0 and 11.0 km from these locations, respectively (Fig. 1). It is important to note that there are four other Environmental Protection Areas in the surroundings – Rio Vermelho, Alto Rio Turvo, Quiriri and Campos do Quiriri – distant 4.5, 9.5, 24.0 and 33.5 km from the present record locality, respectively. In addition, there is also the Bracinho Ecological Station, a private conservation area, located 4.6 km from the study area. Together with the Serra da Dona Francisca Environmental Protection Area, these areas add up 86,174 ha preserved and interconnected with each other and with the Serra do Mar Ecological Corridor (Fig. 1).

This scenario certainly contributes to the maintenance of populations of the *T. terrestris* in the northern region of the state of Santa Catarina and highlights the importance of environmental protection areas for the conservation of this species. Our records, besides contributing information about the lowland tapir range area in southern Brazil, provide new evidence of a recent occurrence of this species in Santa Catarina, and the only Santa Catarina report of individuals outside a legally protected area within the last 30 years. This reinforces the important role of maintaining particular forest remnants, where the absence of anthropogenic pressures can enable the gradual restocking of threatened species, as well as the interconnections between conservation units. Furthermore, in an even broader context, this highlights the ecological role of the Serra do Mar for the conservation of the species.

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References

- Aguiar AP, Chiarello AG, Mendes SL, Matos EN (2003) The Central and Serra do Mar Corridors in the Brazilian Atlantic Forest. In: Galindo-Leal C, Câmara IG (Eds) The Atlantic Forest of South America: Biodiversity Status, Threats and Outlook. Island Press, Washington, 118–132.
- Almeida FFM, Carneiro DR (1998) Origem e Evolução da Serra do Mar. *Revista Brasileira de Geociencias* 28(2): 135–150. <https://doi.org/10.25249/0375-7536.1998135150>
- Azevedo TR, El Achkar DMF, Martins MF, Ximenez A (1982) Lista sistemática dos mamíferos de Santa Catarina conservados nos principais museus do estado. *Revista Nordestina de Biologia* 5: 93–104.
- Bodmer RE (1991) Strategies of seed dispersal and seed predation in Amazonian ungulates. *Biotropica* 23(3): 255–261. <https://doi.org/10.2307/2388202>
- Bornschein MR, Corrêa L, Belmonte-Lopes R, Klemann L Junior, Cáceres NC, Pie MR (2012) The use of highlands by the Lowland Tapir (*Tapirus terrestris*) in the southern

- Brazilian Atlantic forest. *Neotropical Biology and Conservation* 7(3): 210–213. <https://doi.org/10.4013/nbc.2012.73.07>
- Brasil (2014) Ministério do Meio Ambiente – MMA. Portaria nº 444, de 17 de dezembro de 2014. Lista Nacional Oficial de Espécies da Fauna Ameaçadas de Extinção.
- Cabral DC, Cesco S (2008) Notas para uma História da Exploração Madeireira na Mata Atlântica do Sul-Sudeste. *Ambiente & Sociedade* 11(1): 33–48. <https://doi.org/10.1590/S1414-753X2008000100004>
- Carvalho MMX (2006) O desmatamento das florestas de araucária e o Médio Vale do Iguaçu: uma história de riqueza madeireira e colonizações [dissertation]. [Florianópolis (SC)]: Universidade Federal de Santa Catarina.
- Castilho PV, Simões-Lopes PC (2001) Zooarqueologia dos mamíferos aquáticos e semi-aquáticos da Ilha de Santa Catarina, sul do Brasil. *Revista Brasileira de Zoologia* 18(3): 719–727. <https://doi.org/10.1590/S0101-81752001000300008>
- Cherem JJ, Simões-Lopes PC, Althoff S, Graipel ME (2004) Lista dos mamíferos do estado de Santa Catarina, sul do Brasil. *Mastozoología Neotropical* 11(2): 151–184. <https://www.redalyc.org/pdf/457/45711202.pdf>
- Coppolillo P, Gomez H, Maisels F, Wallace R (2004) Selection criteria for suites of landscape species as a basis for site-based conservation. *Biological Conservation* 115(3): 419–430. [https://doi.org/10.1016/S0006-3207\(03\)00159-9](https://doi.org/10.1016/S0006-3207(03)00159-9)
- Cullen L, Rudran R (2006) Transectos lineares na estimativa de densidade de mamíferos e aves de médio e grande porte. In: Cullen L, Rudran R, Valladares-Padua C (Orgs) Métodos de Estudos em Biologia da Conservação e Manejo da Vida Silvestre. Editora da Universidade Federal do Paraná, Curitiba, 169–180.
- Cullen Jr L, Bodmer RE, Valladares-Padua CB (2000) Effects of hunting in habitat fragments of the Atlantic Forests, Brazil. *Biological Conservation* 95(1): 49–56. [https://doi.org/10.1016/S0006-3207\(00\)00011-2](https://doi.org/10.1016/S0006-3207(00)00011-2)
- Dario FR (2014) Frugivory and seed dispersal by mammals in the Amazon rainforest. *Asian Journal of Biological and Life Sciences* 3(2): 137–142.
- De Angelo C, Paviolo A, Di Blanco Y, Di Bitetti M (2015) Guía de Huellas de Los Mamíferos de Misiones y Otras Áreas del Subtrópico de Argentina. Segunda Edición. Edicionaes del Subtrópico, Tucumán, 120 pp.
- Downer CC (2003) Tapirs (Tapiridae). In: Hutchins M, Kleiman DG, Geist V, McDade MC (Eds) Grzimek's Animal Life Encyclopedia. Vol 15 – Mammals. IV. Farmington Hills (MI), Gale Group, 237–248.
- Ferrasso S, Schmitz PI (2013) Arqueofauna de um sítio guarani em Itapiranga, no Vale do Alto Uruguai (SC, Brasil): SC-U-1 (Itapiranga 1). *Cuadernos del Instituto Nacional de Antropología y Pensamiento Latinoamericano – Series Especiales* 4(1): 127–136. <http://ppct.caicyt.gov.ar/index.php/cinapl-se/article/view/4018/pdf>
- Fialho MS (2007) Riqueza e abundância da fauna de médio e grande porte em três modelos de áreas protegidas no Sul do Brasil. Tese (Doutorado em Ecologia). Universidade de Campinas, 118 pp.
- Fragoso JMV (1997) Tapir-generated seed shadows: Scaledependent patchiness in the Amazon rain forest. *Journal of Ecology* 85(4): 519–529. <https://doi.org/10.2307/2960574>

- Giombini MI, Bravo SP, Tosto DS (2016) The key role of the largest extant Neotropical frugivore (*Tapirus terrestris*) in promoting admixture of plant genotypes across the landscape. *Biotropica* 48(4): 499–508. <https://doi.org/10.1111/btp.12328>
- IBGE – Instituto Brasileiro de Geografia e Estatística (2012) Manual Técnico da Vegetação Brasileira. Série Manuais Técnicos em Geociências 1 (2nd ed.). Rio de Janeiro, IBGE.
- IUCN – International Union for Conservation of Nature (2020) Red List of Threatened Species. <http://www.iucnredlist.org>
- Joinville (2012) Plano de Manejo da Área de Proteção Ambiental Serra Dona Francisca. Joinville: Prefeitura Municipal de Joinville. <https://www.joinville.sc.gov.br/wp-content/uploads/2016/07/Plano-de-manejo-da-%C3%81rea-de-Prote%C3%A7%C3%A3o-Ambiental-APA-Serra-Dona-Francisca.pdf>
- Kasper CB, Mazim FD, Soares JBG, de Oliveira TG, Fabián ME (2007) Composição e abundância relativa dos mamíferos de médio e grande porte no Parque Estadual do Turvo, Rio Grande do Sul, Brasil. *Revista Brasileira de Zoologia* 24(4): 1087–1100. <https://doi.org/10.1590/S0101-81752007000400028>
- Klein RM (1978) Mapa fitogeográfico do estado de Santa Catarina. In: Reitz R (Ed.) *Flora Ilustrada Catarinense*. Herbário Barbosa Rodrigues, Itajaí.
- Martins L, Marenzi RC, Lima A (2015) Levantamento e representatividade das Unidades de Conservação instituídas no Estado de Santa Catarina, Brasil. *Desenvolvimento e Meio Ambiente* 33: 241–259. <https://doi.org/10.5380/dma.v33i0.36900>
- Medici EP (2010) Assessing the viability of lowland tapir populations in a fragmented landscape. Thesis (Doctor of Philosophy in Biodiversity and Management). University of Kent, 292 pp.
- Medici EP, Desbiez ALJ (2012) Population viability analysis (PVA): Using a modeling tool to assess the viability of tapir populations in fragmented landscapes. *Integrative Zoology* 7(4): 356–372. <https://doi.org/10.1111/j.1749-4877.2012.00318.x>
- Medici EP, Flesher K, Beisiegel BM, Keuroghlian A, Desbiez ALJ, Gatti A, Pontes ARM, Campos CB, Tófoli CF, Moraes Júnior EA, Azevedo FC, Pinho GM, Cordeiro JLP, Santos Júnior TS, Morais AA, Mangini PR, Rodrigues LF, Almeida LB (2012) Avaliação do Risco de Extinção da anta brasileira *Tapirus terrestris* Linnaeus, 1758, no Brasil. *Biodiversidade Brasileira* 2(1): 3–11.
- Olimpio J (1995) Conservação da fauna de mamíferos silvestres da ilha de Santa Catarina: aspectos biogeográficos, históricos e sócio-ambientais. Dissertation, Florianópolis, Brazil: Universidade Federal de Santa Catarina.
- Olimpio J, Althoff SL, Perez DM (1991) Lista preliminar de mamíferos da bacia do Rio Cubatão, Joinville – SC, proveniente do RIMA da UHE/Cubatão. *Anais do XVIII Congresso Brasileiro de Zoologia*.
- Oliveira-Santos LGR, Machado-Filho LCP, Tortato MA, Brusius L (2010) Influence of extrinsic variables on activity and habitat selection of lowland tapirs (*Tapirus terrestris*) in the coastal sand plain shrub, southern Brazil. *Mammalian Biology* 75(3): 219–226. <https://doi.org/10.1016/j.mambio.2009.05.006>
- Paolucci LN, Pereira RL, Rattis L, Silvério DV, Marques NCS, Macedo MN, Brando PM (2019) Lowland tapirs facilitate seed dispersal in degraded Amazonian forests. *Biotropica* 51(2): 245–252. <https://doi.org/10.1111/btp.12627>

- Prist PR, Silva MX, Papi B (2020) Guia de Rastros de Mamíferos Neotropicais de Médio e Grande Porte. Fólio Digital, São Paulo, 247 pp. <https://doi.org/10.24328/2020/86911.00>
- Rosa AO (1998) Arqueofauna de um sítio litorâneo do estado de Santa Catarina. *Revista de Arqueologia* 11(1): 9–14. <https://doi.org/10.24885/sab.v11i1.132>
- Santa Catarina (2011) Conselho Estadual de Meio Ambiente – CONSEMA. Resolução nº 002, de 06 de dezembro de 2011. Reconhece a Lista Oficial de Espécies da Fauna Ameaçadas de Extinção no Estado de Santa Catarina e dá outras providências.
- Santos LGRO, Machado Filho LCP, Tortato MA, Falkenberg DB, Hötzel MJ (2005) Diet of Tapirs (*Tapirus terrestris*) introduced in a salt marsh area of the Baixada do Massiambu, State Park of the Serra do Tabuleiro – Santa Catarina, South of Brazil. *Tapir Conservation* 14(18): 22–27.
- Sekiana ML, Lima IP, Rocha VJ (2011) Ordem Perissodactyla. In: Reis NR, Peracchi AL, Pedro WA, Lima IP (Eds) *Mamíferos do Brasil*. Nélío R. dos Reis, Londrina, 289–292.
- Silva Jr AP, Mendes-Pontes AR (2008) The effect of a mega-fragmentation process on large mammal assemblages in the highly-threatened Pernambuco Endemism Centre, north-eastern Brazil. *Biodiversity and Conservation* 17(6): 1455–1464. <https://doi.org/10.1007/s10531-008-9353-0>
- Taber A, Chalukian SC, Altrichter M, et al. (2007) El destino de los arquitectos de los bosques neotropicales: evaluación de la distribución y el estado de conservación de los pecaríes labiados y los tapires de tierras bajas. WCS, Tapir Specialist Group e Grupo Especialista de laCSE/UICN en cerdos, pecaríes y hipopótamos.
- Tófoli CF (2006) Frugivoria e dispersão de sementes por *Tapirus terrestris* (Linnaeus, 1758) na paisagem fragmentada do Pontal do Paranapanema, São Paulo. Dissertation, Universidade de São Paulo, São Paulo.
- Tortato FR, Testoni AF, Althoff SL (2014) Mastofauna terrestre da Reserva Biológica Estadual do Sassafrás, Doutor Pedrinho, Santa Catarina, sul do Brasil. *Biotemas* 27(3): 123–129. <https://doi.org/10.5007/2175-7925.2014v27n3p123>
- Vibrans AC, McRoberts RE, Lingner DV, Nicoletti AL, Moser P (2013) Extensão original e remanescentes da Floresta Ombrófila Densa em Santa Catarina. In: Vibrans AC, Seveg-nani L, Gasper AL, Lingner DV (Eds) *Inventário Florístico Florestal de Santa Catarina: Floresta Ombrófila Densa*. Edifurb, Blumenau, 25–36.
- Vidolin GP, Biondi D, Wandembruck A (2011) A anta (*Tapirus terrestris*) em fragmentos de Floresta com Araucária, Paraná, Brasil. *Floresta* 41(4): 685–694. <https://doi.org/10.5380/rf.v41i4.25334>